

ABSTRACT

**METHOD OF IDENTIFYING AN EXTREME INTERACTION
PITCH REGION, METHODS OF DESIGNING MASK
PATTERNS AND MANUFACTURING MASKS, DEVICE
MANUFACTURING METHODS AND COMPUTER PROGRAMS**

Optical proximity effects (OPEs) are a well-known phenomenon in photolithography. OPEs result from the structural interaction between the main feature and neighboring features. It has been determined by the present inventors that such structural interactions not only affect the critical dimension of the main feature at the image plane, but also the process latitude of the main feature. Moreover, it has been determined that the variation of the critical dimension as well as the process latitude of the main feature is a direct consequence of light field interference between the main feature and the neighboring features. Depending on the phase of the field produced by the neighboring features, the main feature critical dimension and process latitude can be improved by constructive light field interference, or degraded by destructive light field interference. The phase of the field produced by the neighboring features is dependent on the pitch as well as the illumination angle. For a given illumination, the forbidden pitch region is the location where the field produced by the neighboring features interferes with the field of the main feature destructively. The present invention provides a method for determining and eliminating the forbidden pitch region for any feature size and illumination condition. Moreover, it provides a method for performing illumination design in order to suppress the forbidden pitch phenomena, and for optimal placement of scattering bar assist features.